PM7650-AF
Plug-in Marker Heads

KAY ELECTRIC CO.

We would like to maintain contact with the people who use or fix our instruments. Would you please complete the following and return to us—

7650 - AF

Your Name .....

Company .....

Div. or Dept. .....

Street .....

City, Zone, State .....

Telephone No. .....

Do you use this instrument? ..... ☐

Maintain or repair it? ..... ☐

Should we be doing something to help you? .....

.....

.....

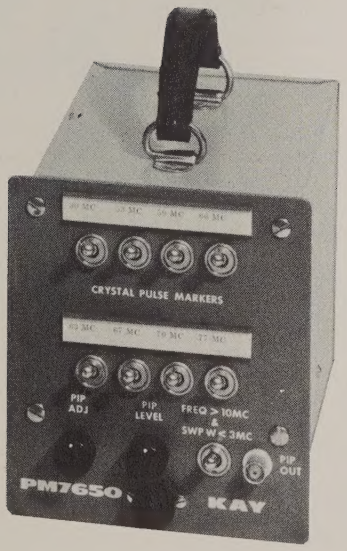
Send extra manual on Model ..... .

Send general data ..... ☐

TEAR OFF AT THIS LINE

OPERATOR'S & MAINTENANCE MANUAL
ISSUE A

OCTOBER 1965



PM-7650AF

KAY ELECTRIC COMPANY
PINE BROOK, NEW JERSEY
CA-7-2000

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SECTION I

PRELIMINARY INFORMATION

1.1 INTRODUCTION

The PM-7650AF units are plug-in marker heads designed for use with the Marka-Sweep 154-AF sweeping oscillator rack units. Plug-in head No. 1 provides ten crystal-controlled frequency markers at frequencies of 1, 2, 3, 4, 5, 6, 7, 8, 9, and 10 MC. Plug-in head No. 2 provides markers at frequencies of 30, 53, 59, 60, 63, 67, 70, and 77 MC individually controlled by front panel toggle switches. These markers may be inserted in any combination. The frequency markers generated within the plug-in heads are available at two separate OUTPUT jacks; the PIP OUT jack on the PM-7650 and the VERT OUT jack on the Marka-Sweep 154-AF front panel. Internal blanking markers, which are superimposed on the swept RF output are also available, as described in Section II.

1.2 SPECIFICATIONS

Markers:	Plug-in Head No. 1-10 Plug-in Head No. 2-8
Frequencies:	Plug-in Head No. 1 - 1, 2, 3, 4, 5, 6, 7, 8, 9, & 10 MC Plug-in Head No. 2 - 30, 53, 59, 60, 63, 67, 70, & 77 MC
Pip Out Amplitude:	Approximately 7V. peak.
Accuracy:	$\pm$ .05%

1.3 INSTALLATION

Both PM-7650AF heads are shipped complete with the specified crystal markers inserted as indicated on the front panel. Either head may be installed in the basic rack unit with the spare plug-in head stored in the accessory cabinet supplied.

To install, merely slide the Plug-in head into the basic rack unit until it seats properly and turn the pawl fastener clockwise until the head is locked in the rack.

1.4 FUNCTION OF CONTROLS AND TERMINALS

CONTROL OR TERMINAL	POSITION	FUNCTION
CRYSTAL PULSE MARKERS SWITCHES (S-1 thru S-8)	ON (OFF)	Any one of eight (ten - Head #1) frequency markers may be energized by placing the appropriate switch in the up (ON) position. These markers may be operated singly or in any combination. S-1 and S-2 on Plug-in Head #1 control both the 9, 10 and 7, 8 MC. markers respectively.
FREQ ≻ 10 MC. & SWP W ≺ 3 MC. (S-9)	ON (OFF)	When the marker frequency is greater than 10 MC. and the sweep width is less than 3 MC., this switch should be placed in the up position.
PIP LEVEL (R-29)	Variable	Used to vary the amplitude of the markers.
PIP ADJ (External) (R-23)	Variable	Used to tune for stable markers.
PIP ADJ #1 (Internal) (R-22) PIP ADJ #2 (Internal) (R-27)	Variable	These controls are set, during alignment to establish one operating range of the external PIP ADJ control.
PIP OUT Jack (P-3)	-------	Frequency markers approximately 7V. peak, are available at this jack.

SECTION II

OPERATING INSTRUCTIONS

2.1 OPERATING PROCEDURE

General Operation

After the instructions provided in the Installation Section have been followed, the frequency markers desired can be energized by placing the associated MARKER switches in the up position. If the frequency of the desired marker is greater than 10 MC and the sweep width of the Marka-Sweep is less than 3 MC, the FREQ. > 10 MC & SWP W < 3 MC switch should be placed in the up position. The PIP LEVEL control may then be adjusted to provide markers of a convenient amplitude. The PIP ADJ control should be set to provide stable marker pulses for all activated marker positions, with no interaction between switch positions. Optimum setting for the PIP ADJ control is between the points where all activated markers are present and where double-firing occurs.

Internal Markers

Markers may be superimposed on the swept RF output by placing the INT-BYPASS switch, located in the rear of the basic rack chassis, in the INT position. These markers will appear as "suckouts" on the RF signal. When the internal markers are not in use, this switch should be in the BYPASS position. Markers are present at both the PIP OUT and VERT jacks when the INT-BYPASS switch is in the INT position.

2.2 CHECK-OUT PROCEDURE

Electrical check-out of the PM-7650AF may be completed quickly using only a scope. Set up the sweep generator to display the detected response curve of a full sweep. Pips are working properly if the PIP LEVEL control varies the amplitude of the pips, and stable pips can be obtainable over a reasonable rotation of the PIP ADJ control. Turning the PIP ADJ control to its minimum position should result in a complete extinguishing of the pips. Approximately 7 volts peak should be available at the PIP OUT jack.

SECTION III

ALIGNMENT PROCEDURE

3.1 CRYSTAL CIRCUITS

Equipment Required:

MARKA-SWEEP 154-AF
CW Generator, Tektronix 190B or equiv.
CW Generator, Kay Utilator or equiv.
Frequency Meter, Beckman 7175 or equiv.
Oscilloscope, Tektronix 571 or equiv.

A. Remove the Marka-Sweep 154-AF from its cabinet and install the PM-7650AF Plug-in Head.

B. Preliminary Settings:

FUNCTION SELECTOR	-	LINE LOCK
BLANKING	-	ON
CENTER FREQUENCY & SWEEP WIDTH controls	-	Compatible with marker frequencies under test
RF OUTPUT control	-	Fully CW
MARKERS	-	BYPASS
SWEEP	-	NORMAL

C. Place all Marker Switches, S-1 thru S-8, in the ON (up) Position.

D. Connect the HOR AND EXT MOD jack to the HORIZ input terminals of the scope and connect a Test Probe from Feed-Thru Capacitor C-13 to the VERT input terminals of the scope.

E. Adjust C-8 and C-3 to center the detected response about the zero output line. (Tune C-3 for Plug-in Head #2 only).

F. (Head #2 Only) - Set the SWEEP WIDTH control to approx. 35 MC. Adjust L-1 for maximum amplitude of the 30 MC marker, and C-1 and L-2 for maximum amplitude of the remaining markers. Connect the vert scope probe to the emitter of Q-2 and adjust L-3 thru L-10 for maximum amplitude of the desired marker frequencies (2.5 volts peak, approx.). Select R-5 thru R-8 and R-11 thru R-14, if necessary, to obtain equal amplitude (within 2V.) of all markers.

G. Disconnect P-4 from J-4 and connect equipment as shown in Fig. 3.1.

H. Vary the frequency of the CW Generator until the response noted on the scope rests on the positive peak of a detected marker. Note the exact frequency at which this peak appears.

I. Repeat Step H until all marker frequencies are obtained. Frequencies should be accurate to within $\pm$ .05% of that indicated on the front panel of the PM-7650AF.

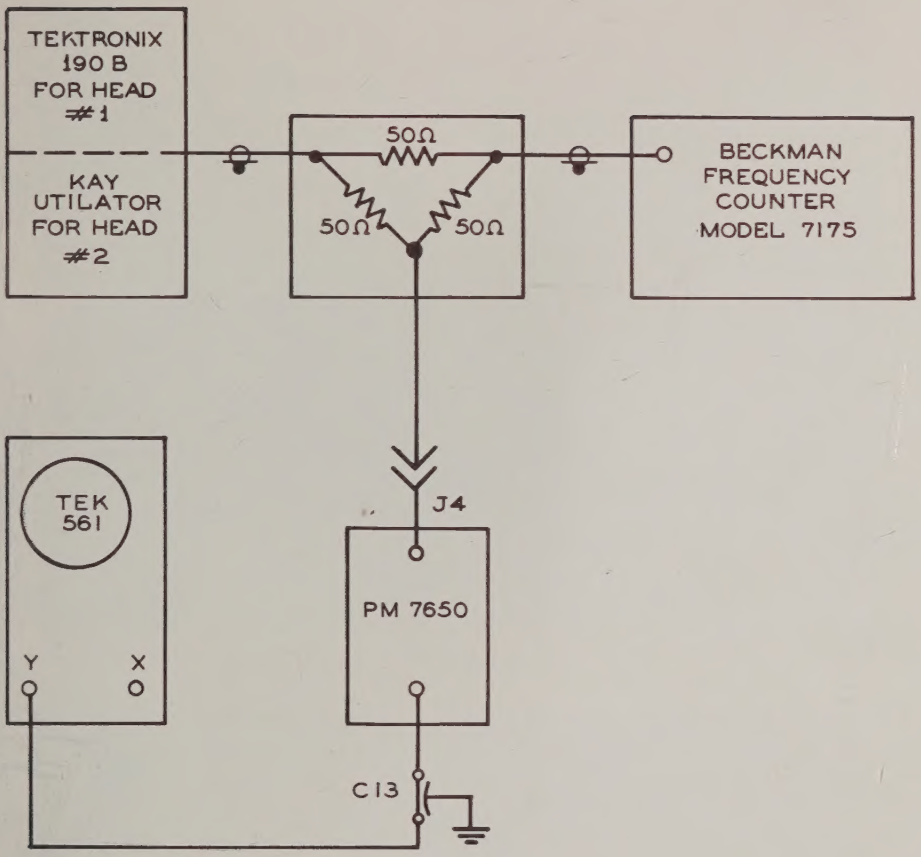


FIG. 3.1

3.2 TRIGGER CIRCUITS

A. Set the rack unit controls as indicated in Step 3.1B.

B. Connect the HOR AND EXT MOD jack to the HORIZ terminal of the scope and the test probe between the Base (B1) of Q-3 and the VERT terminal of the scope.

C. With the external PIP ADJ set fully clockwise, adjust PIP ADJ 1 so that markers fire singly.

D. Connect the vert scope probe to the Base (B1) of Q-4 and adjust PIP ADJ 2 so that the markers fire singly.

SECTION IV

MAINTENANCE

4.1 CIRCUIT DESCRIPTION

A sample of the swept RF signal is fed through the buffer amplifier, located in the basic rack unit, which serves to isolate the marker circuits from the sweep generator. This swept RF signal is passed to the crystal filters through a filtering network which consists of C-2 and L-1, for one bank of crystals, and C-1 and L-2 for the second bank. Since the operation of all the crystal filters is the same, operation with only one crystal energized will be examined. As the swept RF approaches the resonant frequency of the filter, the instantaneous CW signal is allowed to pass the detector, (D-2 in one bank, and D-4 in the second bank). The detected envelope, a positive pulse, is passed through the FREQ greater than 10 MC & SWP W less than 3 MC switch. This signal is fed to the crystal marker amplifier which consists of two 2N1377 transistors in a compound amplifier arrangement. The amplified signals are then used to trigger the pip generator. Finally, these pips are passed through isolation diode D-6 where they become positive pulse markers. The markers are made available at both the PIP OUT and VERT jacks.

4.2 VISUAL INSPECTION

The PM-7650AF Plug-in Head should be visually inspected regularly, usually during periodic maintenance checks, for such things as loose or broken connections, or cracked terminal strips. Signs of overheating such as scorched wires or resistors, discolored casings or melted wax may indicate other less apparent troubles.

4.3 PARTS REPLACEMENT

Most components of this instrument are easily accessible and require no special requirement procedures. However, since some of the solid-state components used may be damaged when subjected to intense heat, avoid overheating when soldering the leads of these components. Longnose pliers may be used as a heat sink between the component and the tip of the soldering iron. The soldering iron should be hot before touching the solder joint, and removed immediately after the solder flows. The tip of the iron should be electrically at ground potential so that semiconductor components having low voltage ratings will not be damaged.

4.4 TROUBLESHOOTING DATA

NO MARKER OUTPUT FROM PM-7650AF IN ANY MODE.

If the crystal circuit output is normal as indicated by the tests performed in Paragraph 3.1, check the circuitry of MARKER AMPLIFIERS Q-1 & Q-2 and PIP GEN Q-3 & Q-4. Refer to the voltages given in Fig. 4.2 and pulse waveforms provided on the schematic diagram. If the output of the crystal circuit is abnormal, check diodes D-1 thru D-4, RF input cable P2-P4 and Buffer Amplifier Q-19 in the basic rack unit.

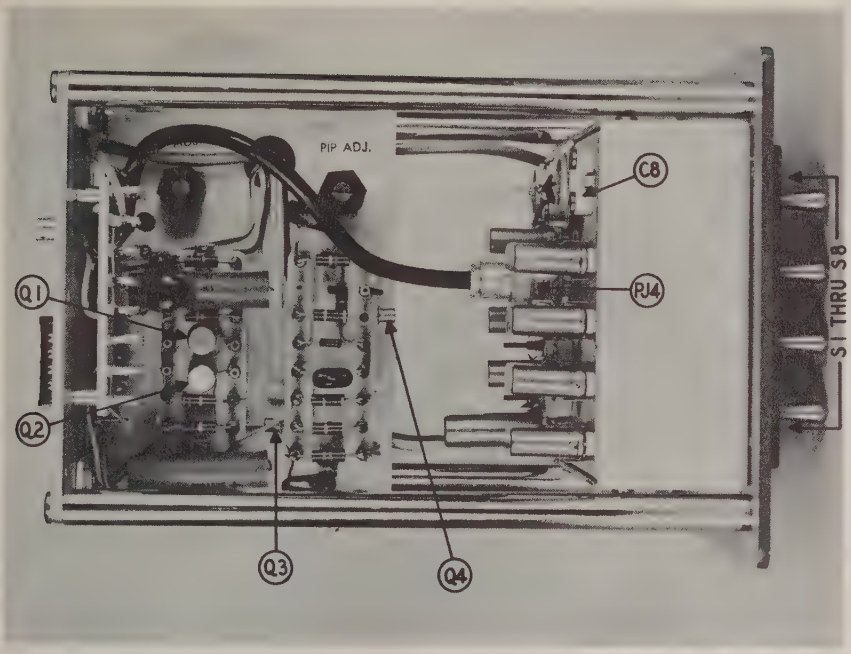


FIG. 4.1 - PM-7650AF, TOP VIEW

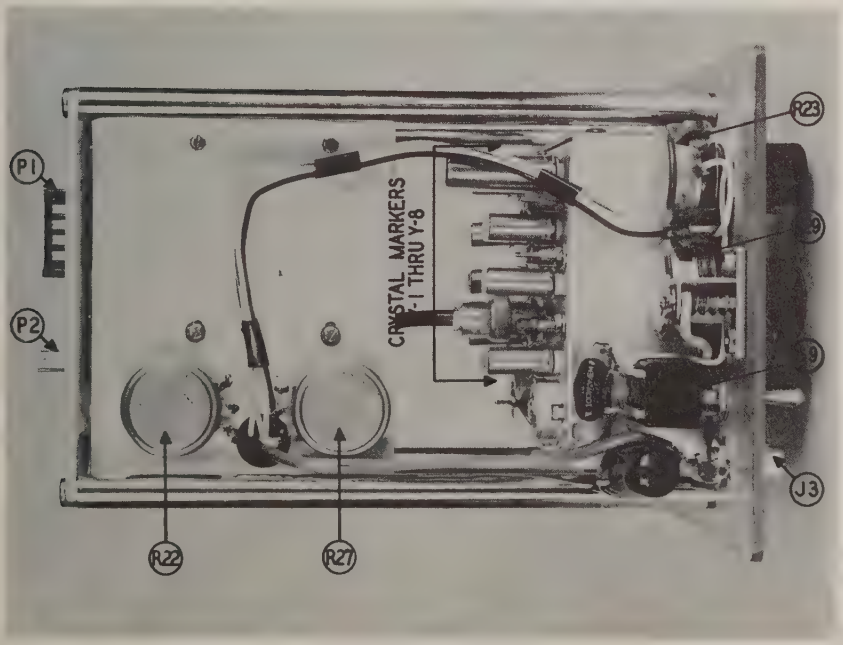


FIG. 4.2 - PM-7650AF, BOTTOM VIEW

4.5 PARTS LIST

To insure satisfactory performance, use only exact replacement parts when making repairs. These are available from the Kay Electric Company. Please make reference to the instrument type, serial number, circuit symbol number, and Kay part number when ordering.

4.5.1 PARTS LIST - PLUG-IN HEAD #1

CAPACITORS: (All capacitors in μμf, 500 volts, unless otherwise indicated).

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MFG. & MFG. PART NO.	
C1	5, Silver Mica	6359-52	Elmenco	DM15-050
C2	10, Silver Mica	6359-53	"	DM15-100
C3	20, Silver Mica	6359-57	"	DM15-200
C4 thru C7	Factory Selected	-------	--------	---------
C8	7-45, Ceramic Trimmer	6358-7	Erie 503000	D2PO 33R
C9 thru C12	Factory Selected	------	--------	---------
C13	4000, Ceramic Feed-thru	6356-5	Erie X5V2443-4000GMV	
C14	25μf, 25V. Electrolytic	6355-78	Sprague	Type 40D
C15	.5μf, 100V. Mylar-paper	6899-21	Elmenco	1DP-3-504
C16	Factory Selected	-------	--------	---------
C17	18μf, 100V., Electrolytic	6355-73	Sprague	Type 40D
C18	.01μf, 400V., Mylar-paper	6899-8	Elmenco	4DP-1-103
C19	500, Silver Mica	6359-66	"	DM-15-501
C20	75μf, 25V., Electrolytic	6355-80	Sprague	Type 40D
C21	.02μf, 100V., Mylar-paper	6899-13	Elmenco	1DP-1-203
C22	1.0μf, 100V., Mylar	6411-17	Cornell Dubilier WMF1W1	
C23	500, Silver Mica	6359-66	Elmenco	DM-15-501
C24	25μf, 25V., Electrolytic	6355-78	Sprague	Type 40D
C25	.01μf, 400V., Mylar-paper	6899-8	Elmenco	4DP-1-103
DIODES				
D1 & D2	Not Used	-------	--------	---------
D3 & D4	Silicon, 6642	6357-91	Sylvania	6642
D5	Silicon, 1N461	6357-57	Texas	1N461
CONNECTORS				
J1 & J2	Not Used	------	-------	---------
J3 & J4	Coax, UG625/U	451	Dage	UG625U
COILS				
L1	RF, 60-90μh	6394-29	Caddell Burns	40019
L2	Peaking, 950μh	6394-28	Miller	6157
L3 thru L10	Not Used	-------	-------	---------
L11	Peaking, 950μh	6394-28	Miller	6157
PLUGS				
P1	Male, 26-182	8611	Amphenol	26-182
P2	Coax, UG1050/U	7661	IPC	UG1050/U
P3	Not Used	------	-------	---------
P4	Coax, UG88/U	213	Dage	UG88/U
TRANSISTORS				
Q1 & Q2	2N1377	K134	Texas	2N1377
Q3 & Q4	2N2646	K138	GE	2N2646

RESISTORS: (Unless otherwise specified, all Resistors are fixed composition, ½Watt, 10% Tolerance).

R1	51, ¼Watt, 5% Tol.	5105-C	Allen Bradley	CB5105
R2 thru R4	1K, ¼Watt	1021-C	" "	CB1021
R5	470	4711-E	" "	EB4711
R6 thru R14	Not Used	------	--------	-------

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MFG. & MFG. PART NO.
R15	56K	5631-E	Allen Bradley EB5631
R16	10K	1031-E	" " EB1031
R17	2.2K	2221-E	" " EB2221
R18	10K	1031-E	" " EB1031
R19	1K	1021-E	" " EB1021
R20	15K	1531-E	" " EB1531
R21	4.7K	4721-E	" " EB4721
R22	5K, 2Watt, pot, Variable	142	" " JA2N048S502UE
R23	10K, 2Watt, pot, Variable	108	" " JA2N048S103UE
R24	3.3K	3321-E	" " EB3321
R25	1M	1051-E	" " EB1051
R26	10K	1031-E	" " EB1031
R27	5K, 2Watt, pot, Variable	142	" " JA2N048S502UE
R28	4.7K	4721-E	" " EB4721
R29	5K, 2Watt, pot, Variable	142	" " JA2N048S502UE
R30	27K	2731-E	" " EB2731
R31	1300 Thermistor	9292-6	Fenwal KA3165
SWITCHES			
S1 thru S8	Toggle DPDT	254-TX	Kay Electric Co.
S9	Toggle DPDT	254-A	A-H&H 81027-CE
CRYSTALS			
Y1	Quartz, 10 MC	Y1/9281A	Hunt Corp.
Y2	Quartz, 7 MC	Y2/9281A	" "
Y3	Quartz, 6 MC	Y3/9281A	" "
Y4	Quartz, 5 MC	Y4/9281A	" "
Y5	Quartz, 4 MC	Y5/9281A	" "
Y6	Quartz, 3 MC	Y6/9281A	" "
Y7	Quartz, 2 MC	Y7/9281A	" "
Y8	Quartz, 1 MC	Y8/9281A	" "
Y9	Quartz, 8 MC	Y9/9281A	" "
Y10	Quartz, 9 MC	Y10/9281A	Hunt Corp.

4.5.2 PARTS LIST - PLUG-IN HEAD #2

CAPACITORS: (All capacitors in $\mu\mu$f, 500 volts, unless otherwise indicated).

C1	7-45, Ceramic Trimmer	6358-7	Erie 503000P2PO 33R
C2	50, Silver Mica	6359-60	Elmenco PM-15-500
C3	7-45, Ceramic Trimmer	6358-7	Erie 503000D2PO 33R
C4 thru C7	Factory Selected	-------	------- ----------
C8	7-45, Ceramic Trimmer	6358-7	Erie 503000D2PO 33R
C9 thru C12	Factory Selected	-------	------- ----------
C13	4000, Ceramic Feed-thru	6356-5	Erie X5V2443-4000GMV
C14	.1μf, 100V., Mylar-paper	6899-11	Elmenco 1DP-2-104
C15	25μf, 25V., Electrolytic	6355-78	Sprague Type 40D
C16	Factory Selected	------	------- ----------
C17	18μf, 100V., Electrolytic	6355-73	Sprague Type 40D
C18	.01μf, 400V., Mylar-paper	6899-8	Elmenco 4DP-1-103
C19	500, Silver Mica	6359-66	Elmenco DM15-501
C20	75μf, 25V., Electrolytic	6355-80	Sprague Type 40D
C21	.01μf, 100V., Mylar-paper	6899-12	Elmenco 1DP-1-103
C22	1.0μf, 100V., Mylar	6411-17	Cornell Dubilier WMF1W1
C23	500, Silver Mica	6359-66	Elmenco DM15-501
C24	10, Silver Mica	6359-53	Elmenco DM15-100
DIODES			
D1 & D4	Silicon 6642	6357-91	Sylvania 6642
D5	Silicon 1N461	6357-57	Texas 1N461

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MFG. & MFG. PART NO.
CONNECTORS:			
J1 & J2	Not used		
J3 & J4	Coax, UG-625/U	451	Dage UG-625/U
COILS:			
L1	Low pass, special	8624-2	Kay Electric Co.
L2	High pass, special	8624-11	" " "
L3	63MC, special	8624-10	" " "
L4	70MC, special	8624-10	" " "
L5	77MC, special	8624-10	" " "
L6	59MC, special	8624-9	" " "
L7	53MC, special	8624-10	" " "
L8	60MC, special	8624-10	" " "
L9	67MC, special	8624-10	" " "
L10	30MC, special	8624-7	" " "
PLUGS:			
P1	Male, 26-182	8611	Amphenol 26-182
P2	Coax, UG1050/U	7661	IPC UG1050/U
P3	Not used		
P4	Coax, UG88/U	213	Dage UG88/U
TRANSISTORS:			
Q1 & Q2	2N1377	K134	Texas 2N1377
Q3 & Q4	2N2646	K138	G. E. 2N2646

RESISTORS: (unless otherwise specified, all resistors are fixed composition, $\frac{1}{2}$ watt, 10% tolerance).

R1	51, $\frac{1}{4}$Watt, 5% tol.	5105-C	Allen-Bradley CB5105
R2	Factory selected	------	----------
R3	220, $\frac{1}{2}$Watt	2211-C	Allen-Bradley CB2211
R4	220, $\frac{1}{4}$Watt	2211-C	Allen-Bradley CB2211
R5 thru R8	Factory selected	------	----------
R9 & R10	220, $\frac{1}{4}$Watt	2211-C	Allen-Bradley CB2211
R11 thru R14	Factory selected	------	----------
R15	56K	5631-E	Allen-Bradley EB5631
R16	10K	1031-E	" " EB1031
R17	2.2K	2221-E	" " EB2221
R18	10K	1031-E	" " EB1031
R19	1K	1021-E	" " EB1021
R20	15K	1531-E	" " EB1531
R21	4.7K	4721-E	" " EB4721
R22	5K, 2Watt pot, variable	142	" " JA2N048S502UE
R23	10K, 2Watt pot, variable	108	" " JA2N048S103UE
R24	3.3K	3321-E	" " EB3321
R25	1M	1051-E	" " EB1051
R26	10K	1031-E	" " EB1031
R27	5K, 2Watt pot, variable	142	" " JA2N048S502UE
R28	4.7K	4721-E	" " EB4721
R29	5K, 2Watt pot, variable	142	" " JA2N048S502UE
R30	27K	2731-E	" " EB2731
R31	10K	1031-E	" " EB1031
R32	1300 Thermistor	9292-6	Fenwal KA31L5
SWITCHES:			
S1 thru S8	Toggle, DPDT	254-TX	Kay Electric Co.
S9	Toggle, DPDT	254-A	A-H & H 81027-CE
CRYSTALS:			
Y-1	Quartz, 63MC	Y1/9282A	Hunt Corp.

DWG. SYMBOL NO.	DESCRIPTION	KAY PART NO.	MFG. & MFG. PART NO.
Y-2	Quartz, 70MC	Y2/9282A	Hunt Corp.
Y-3	Quartz, 77MC	Y3/9282A	" "
Y-4	Quartz, 59MC	Y4/9282A	" "
Y-5	Quartz, 53MC	Y5/9282A	" "
Y-6	Quartz, 60MC	Y6/9282A	" "
Y-7	Quartz, 67MC	Y7/9282A	" "
Y-8	Quartz, 30MC	Y8/9282A	" "

4.6 RESHIPMENT INSTRUCTIONS

Permission to return equipment should, in every case, be obtained from the factory or an accredited Kay representative before return shipment is made.

If it becomes necessary to return the PM-7650AF to the factory for repair, it should be securely padded to cushion the instrument during transit. A packing slip should be included in the carton furnishing identification of the shipper. The packing slip should also reference the instrument type and serial number. A statement indicating the nature of the malfunction should be included for the benefit of service personnel.

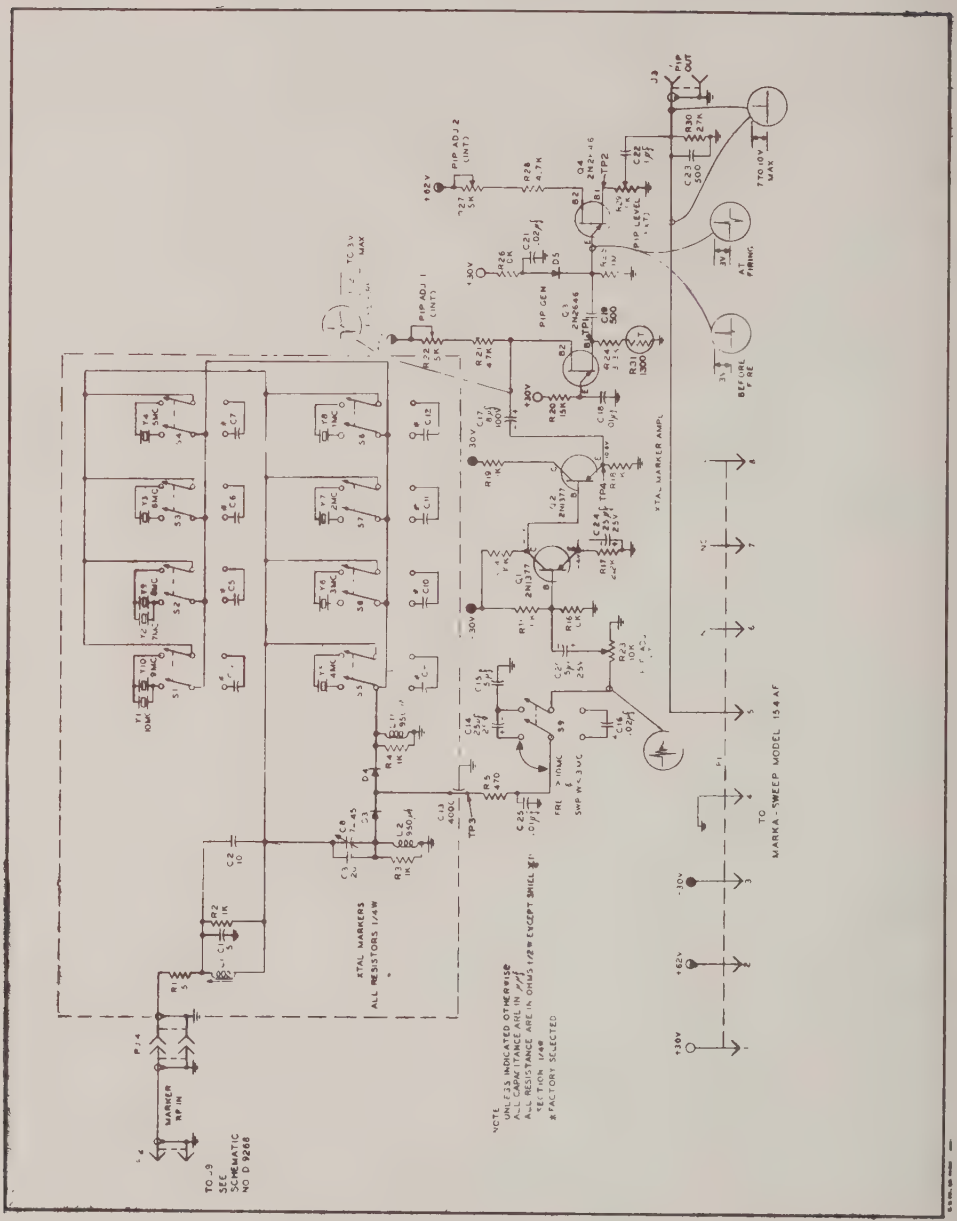


FIG. 4.3 - PLUG-IN HEAD #1, SCHEMATIC, C-9281-A

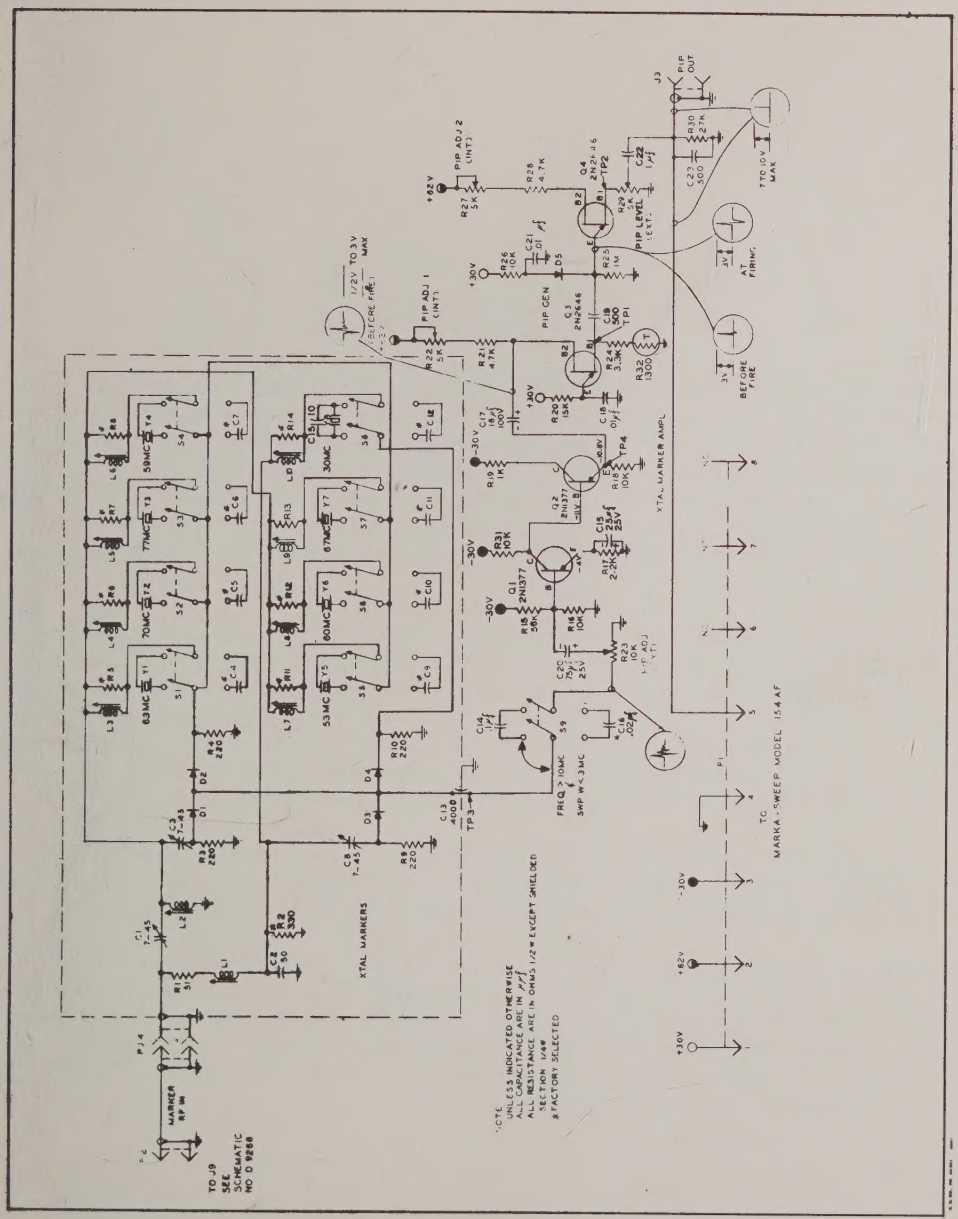


FIG. 4.4 - PLUG-IN HEAD #2, SCHEMATIC, C-9282-A

GOVERNMENT GUARANTEE

Each unit and each part, except transistors, batteries, natural rubber, and material normally consumed in operation (unless such excepted items fail as a result of improper application, in which case the guarantee applies to these items also), is guaranteed for a period of one year from the date it is placed in operation by the Government, but not more than two years from the date of acceptance by the Government. Upon notice in writing of such failures, the contractor shall repair or replace all such items F. O. B. any point within the continental limits of the United States designated by the Government, without delay and at no expense to the Government.

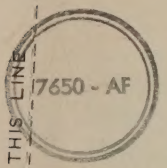
If 20% or more of the total quantity of any part or component to which the above guarantee applies, but no less than two of any such part or component furnished under this contract, fail in normal service, that fact shall be conclusive evidence that the particular part or component, or the item or part design, is unsuitable for the purpose intended. The contractor upon notice of this fact shall replace or correct the item or part design in a manner satisfactory to the Government in all items and parts without cost to the Government, unless the use of such part, component, or design was required by the Government.

The above guarantee period shall not include any period of time the item or part fails to perform satisfactorily due to any such defect and any item or part repaired by the contractor pursuant to this guarantee shall itself be guaranteed as specified above.

The contractor may elect to have any defective or damaged item or part returned to his plant, he to pay the return transportation charge, but he shall not delay the prompt replacement of the defective or damaged item or part. If, upon examination of the defective or damaged item or part, it can be shown to the satisfaction of the Government that the item or part is not defective within the meaning of this guarantee, the contractor may bill the Government for the cost of replacement, including transportation.

TEAR OFF AT THIS LINE

We would like to maintain contact with the people who use or fix our instruments. Would you please complete the following and return to us—



Your Name.....

Company .....

Div. or Dept. .....

Street .....

City, Zone, State .....

Telephone No. .....

Do you use this instrument? ..... ☐

Maintain or repair it? ..... ☐

Should we be doing something to help you?.....

.....

.....

Send extra manual on Model.....

Send general data..... ☐

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